

Ms. Daphne Kamely
Acting Deputy Assistant Secretary of the Army
Installations and Environment
Department of the Army
110 Army Pentagon
Washington, DC 20310-0110

Dear Ms. Kamely:

Thank you for your letter of September 1, 2005, requesting guidance for generators disposing of fully-discharged lithium sulfur dioxide (Li-SO₂) batteries. In your letter, you asked EPA to consider two distinct questions regarding the management of fully-discharged Li-SO₂ batteries: whether batteries that have been fully-discharged, but maintain a minimal voltage, would be considered hazardous waste; and whether the universal waste regulations allow the discharge of Li-SO₂ batteries as battery management (rather than RCRA treatment) and allow final battery disposal at solid waste landfills.

As you noted in your correspondence, EPA stated, in a March 18, 1987 letter to DoD, “that Li-SO₂ batteries that have been fully discharged to zero volts would not likely exhibit the characteristic of reactivity.” This 1987 letter reflects EPA’s policy that a fully discharged Li-SO₂ battery would have zero volts, and such a battery would be unlikely to exhibit the reactivity characteristic.

The initial guidance regarding Li-SO₂ batteries set forth by this Agency was in 1984 where it concluded that “lithium-sulfur dioxide batteries clearly exhibit the characteristic of reactivity as defined in 40 CFR 261.23.”¹ While the 1984 letter did not address fully-discharged Li-SO₂ batteries, the concerns regarding the potential for Li-SO₂ batteries to exhibit the characteristic of reactivity are important in the consideration of your request for guidance.

Based on the information provided in the November 2004 U.S. Army Communications and Electronics Command (CECOM) report entitled “Lithium-Sulfur Dioxide Batteries Technical Report Reactivity,”² we generally agree that Li-SO₂ batteries that have been

¹ Refer to March 7, 1984, letter from Lee Thomas, Environmental Protection Agency, to Dick Burner, Defense Logistics Agency.

² Refer to “Lithium-Sulfur Dioxide Batteries Technical Report Reactivity”, Klimek, Philip D., US Army CECOM, Directorate for Safety, AMSEL-SF-SI, November 2004.

discharged through the use of a Complete Discharge Device (CDD) to a voltage of one volt per cell or less are unlikely to be reactive under plausible management conditions.

The studies described in the 2004 CECOM report extensively tested discharged Li-SO₂ batteries to determine the potential for a cell that has been discharged to a voltage of one volt or less to react violently or vent its contents due to mechanical shock, short circuiting, heat generation from voltage discharge, penetration, and/or immersion in water. The report also included an assessment of the availability of lithium in discharged batteries for “violent reaction with water.” The results of these studies adequately demonstrated that the Li-SO₂ batteries tested in which each cell has been discharged to a voltage of one volt or less would not be considered reactive based on 40 CFR 261.23(a)(1), (a)(2), (a)(3), (a)(6), or (a)(7). Because Li-SO₂ batteries are not classified as forbidden, class A, or class B explosives, they could not be considered reactive based on 40 CFR 261.23(a)(8).

The 1984 letter from EPA stated, “[O]f primary concern is the potential, under existing management practices, for components of the batteries to generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment when those components are mixed with water or exposed to certain pH conditions (40 CFR 261.23(a)(4) and (a)(5)).” The specific “toxic gases, vapors, or fumes” of concern were cyanide gas and hydrocyanic gas. After further communication with your staff, EPA reviewed the U.S. Department of Energy (DOE) report entitled, “Toxicity Study of Selected Military Batteries.”³ The DOE study found no cyanide above the detection limit of 0.1 milligrams per liter (mg/L) in any of the Li-SO₂ battery samples tested. The absence of detectable quantities of total or amenable cyanide therefore supports the conclusion that fully-discharged (i.e., having a voltage of less than 1 volt) Li-SO₂ batteries do not exhibit the characteristic of reactivity described at 40 CFR 261.23(a)(4) and (a)(5).

The Agency’s conclusion that fully-discharged Li-SO₂ batteries are unlikely to exhibit the characteristic of reactivity is specific to the types of batteries tested. Batteries having a different design, having a different chemical composition, or containing cells that are not discharged to a voltage of one volt or less may exhibit different characteristics and need to be evaluated separately. The information from CECOM’s studies and any conclusions associated with the test results should only be extrapolated to other batteries with proper care. Further, any discharged Li-SO₂ batteries that do in fact exhibit a hazardous characteristic (for whatever reason) would be classified as hazardous waste. Under 40 CFR 262.11, the generator of a solid waste must determine if the waste is hazardous.

With regards to the standards for handlers of universal waste, discharge of the batteries so as to remove the electric charge is an acceptable waste management practice under the universal waste rule in 40 CFR 273.13 and 273.33. However, based on the 1984 guidance letter, Li-SO₂ batteries are considered hazardous waste at the time of removal from service. As stated in the final rule for universal waste published in the Federal Register, May 11, 1995,

³ Refer to “Toxicity Study of Selected Military Batteries”, Hanson, Matt, et al., Hazardous Waste Remedial Action Program, managed by Martin Marrieta Energy Systems, Inc. for the U.S. Department of Energy, January 1992.

generators, transporters, and consolidations points managing universal waste are required to comply with all of the substantive land disposal restrictions (LDR) requirements.⁴

As specified in 40 CFR 268.9, under the LDR program, a generator of characteristic hazardous waste must determine any underlying hazardous constituents reasonably expected to be present at levels above the Universal Treatment Standards (UTS) at the point of generation, and the waste may not be land disposed unless it complies with all UTS levels. Therefore, if the Li-SO₂ batteries are reasonably expected to contain acetonitrile at a level greater than its UTS level of 38 milligrams per kilogram (or any other underlying hazardous constituent above its UTS level), the acetonitrile must be treated to the UTS level before the batteries are land disposed.⁵ One option for treatment is recycling, and another option is combustion. Once the batteries have been discharged and are no longer a characteristic hazardous waste, it is not necessary to treat underlying hazardous constituents at a RCRA-permitted facility; however, treatment to meet UTS must occur before the waste is land disposed. Decharacterized universal waste meeting all LDR requirements, including applicable UTS, can be managed as non-hazardous waste (e.g., the waste may be sent to a municipal solid waste landfill).

I hope this letter clarifies EPA's guidance regarding the classification of fully-discharged Li-SO₂ batteries. As you know, the conclusions expressed here rely significantly on your representations of results from tests performed on the fully discharged Li-SO₂ batteries. Should you have questions about EPA's guidance or views on this matter, you may contact my office or Cathy Davis at davis.catherinem@epa.gov or 703-308-7271.

Sincerely,

Matt Hale, Director
Office of Solid Waste

⁴ 60 FR 25492

⁵ Refer to the CECOM Material Safety Data Sheet for Li-SO₂ batteries, which lists acetonitrile as being ~5-6% of the item by weight.